HOMEWORK #1
Due date: Aug 26, 2020

1. How many decimal places do we need to provide for latitude and longitude to describe one's position to $10\,\mathrm{cm}$? Does the accuracy depend on either latitude or longitude itself, i.e. is $\sigma_\varphi \equiv \sigma_\varphi(\varphi, \lambda)$ and $\sigma_\lambda \equiv \sigma_\lambda(\varphi, \lambda)$?

2. You decide to set the world record in free swimming and you set off from San Diego, CA, to Sydney, AU. What is the shortest length of your swimming path? If you could swim $1\,\mathrm{m}$ per second non-stop, how long would you be swimming? Sketch your swimming path and compute all angles and sides. Look up geographic coordinates of San Diego and Sydney online.

3. Two ships are steaming along the parallels of latitude $48°\,\mathrm{N}$ and $15°\,\mathrm{S}$ respectively, in such a way that at any given moment the two ships are on the same meridian of longitude. If the speed of the first ship is 15 knots, find the speed of the second ship.

4. RMS Titanic sunk at $\varphi = 41°43'32''\,\mathrm{N}$, $\lambda = 49°56'49''\,\mathrm{W}$. It traveled from Southampton ($\varphi = 50°54'18''\,\mathrm{N}$, $\lambda = 1°24'12''\,\mathrm{W}$) to New York ($\varphi = 40°16'12''\,\mathrm{N}$, $\lambda = 73°58'48''\,\mathrm{W}$). Was this point on the shortest path between the two cities? If not, how far from it was it?

5. Queen Mary steams from $\varphi = 39°20'00''\,\mathrm{S}$, $\lambda = 110°10'00''\,\mathrm{E}$ to $\varphi = 44°30'00''\,\mathrm{S}$, $\lambda = 46°20'00''\,\mathrm{W}$. What is the shortest possible route between those two points if Queen Mary cannot cross the $62°\,\mathrm{S}$ parallel?

6. *Extra credit:* In a spherical triangle ABC, $C = 90°$, $a = 119°46'36''$ and $B = 52°25'38''$. Compute the values of b, c and A.